

**REMARKS**

The above amendments and the following remarks are fully and completely responsive to the Office Action dated October 3, 2003.

Claims 1-8 are pending in this application. Claims 2-5 and 8 contain allowable subject matter. In the outstanding Office Action, claims 1-7 were rejected under 35 U.S.C. § 112, second paragraph, and claim 1 was rejected under 35 U.S.C. § 102(b). Claims 1-8 are presented for reconsideration.

Entry of this Amendment is proper under 37 C.F.R. § 1.116 since this Amendment: (a) places the application in condition for allowance for reasons discussed herein; (b) does not raise any new issue regarding further search and/or consideration since the Amendment amplifies issues previously discussed throughout prosecution; (c) does not present any additional claims without canceling a corresponding number of finally-rejected claims and (d) places the application in better form for appeal, should an appeal be necessary. The Amendment is necessary because it is made in reply to arguments raised in the rejection. Entry of the Amendment is thus respectfully requested.

**35 U.S.C. § 112, Second Paragraph**

Claims 1-8 (Office Action listed claims 1-7) were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. The Office Action asserts that claim 1 is indefinite for not explaining how linear approximation is carried out. The Office Action also asserts that claims 6 and 7 are indefinite for merely providing a height of rotation

and a swing from that height. The Office Action asserts that claims 6 and 7 do not provide elements to define an apparatus. In addition, the Office Action asserts that the terms “about” and “adapted to” do not clearly define the invention.

With respect to claim 1, the use of the term “linear approximation” is definite. The term “linear approximation” is a common and well-known function in the mathematical arts. Attached are two articles that illustrate that the term “linear approximation” is well known in the art: 1) *Numerical Analysis*, Encyclopedia Britannica; and 2) *Linear Approximation & Error Estimation Miscellaneous*, Hofstra University. Applicant also notes that examples of linear approximation are provided throughout the Specification (page 2, line 25 to page 3, line 12 and page 6, line to page 7, line 8).

Applicants have amended claims 1 and 8 to recite that the linear approximation is performed “by approximating the path of the tip of the arm with a straight line.” This amendment explains how the linear approximation is carried out. Because “approximating a path of the tip of the arm with a straight line” was inherent in the original claim, this amendment does not narrow the claim. Accordingly, Applicant requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph, of claims 1 and 8 and claims 2-5, which depend indirectly or directly on either claim 1 or 8.

Applicant contends that claim 6 is definite and that claim 6 recites the necessary elements to define the arm. Applicant has amended claim 6 to particularly point out and distinctly claim one aspect of the present invention. Accordingly, Applicant requests reconsideration and withdrawal of the rejection under 35 U.S.C. § 112, second paragraph, of claim 6 and claim 7, which depends directly on claim 6.

**35 U.S.C. § 102(b)**

Claim 1 is rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,967,126 to Gretz, et al. ("Gretz"). In making this rejection, the Office Action asserts that Gretz teaches each and every element of the claimed invention. Applicant respectfully requests reconsideration of this rejection.

Amended claim 1 recites, in part, "the fore-and-aft distance to the tip of the arm can be linearly approximated by approximating a path of the tip of the arm with a straight line."

Accordingly, Applicant again notes that Gretz does not teach or suggest the method of designing an arm structure for a robot, as in the present invention. Applicant points out that the present invention uses linear approximation to locate the tip of the robot arm. The linear approximation method is used to simplify the complex calculation of an arcuate trajectory, such as the trajectory of a robot arm. Specifically, linear approximation calculates the trajectory of an arc by approximating the arc as a linear function. One example of a linear function is a straight line. The resulting calculation is an approximation or estimation, as opposed to a precise value, of the arc put in terms of linear function.

In contrast, the Gretz reference teaches or suggests the use homogeneous transformation matrices derived from Denavit-Hartenberg parameters to produce the vector  $r$  reaching from the base point 22 to the tip 24. See Gretz, column 3, lines 3-10. This calculation in the reference provides a precise location of the tip of the arm and involves the use of non-linear equations. The mathematical functions based on the

linear approximation in the present invention are not equivalent to the mathematical functions based on Denavit-Hartenberg parameters in the reference. This is supported by at least the fact that, unlike the reference, the present invention does not use matrices to generate precise values, rather than approximations. Applicant therefore distinguishes the present invention from the reference on the basis of the mathematical functions used to calculate the location and motion of the arm.

Furthermore, contrary to the Examiner's assertion, Applicant contends that the Gretz reference also does not seem to teach or suggest the first element of claim 1, i.e., "selecting a vertical region in front of the robot that can be accessed by the arm in a fully extend state, the location of the selected vertical region being determined with respect to a reference plane." In the present invention, the average height of the vertical range to be accessed is designated as  $H_0$ , and the vertical height of  $H_0$  represents the height of the axis of rotation of the robot arm. See, for example, Specification, page 6, lines 4-9 and Fig. 5. The Office Action asserts that  $L_1$  and  $L_2$  in Figure 1 in Gretz disclose the selection of a vertical region, and that  $L_1$  and  $L_2$  are the same as the vertical region claimed in the present invention.

Applicant again respectfully traverses the anticipation rejection. Applicant contends that the Office's comparison of vertical regions is incorrect. The vertical region claimed by the present invention claims a vertical point extending from a reference plane, such as the horizontal plane. For example, in FIG. 5, the surface of the ground represents the horizontal plane. See Fig. 5 of the Specification. Thus, for example, vector  $H_0$  is measured as a strictly vertical component from the horizontal plane, i.e.,  $H_0$  does not have a horizontal component. See, the Specification, page 6,

lines 4-9 and Fig. 5. The reference, however, does not teach the selection of a strictly vertical region. More specifically,  $L_1$  and  $L_2$  of the reference, as cited by the Office, do not provide a measurement or selection for the vertical region, as in the present invention. The simple addition of the values for  $L_1$  and  $L_2$  does not appear to equal the vertical component, i.e., the vertical region, since  $L_1$  and  $L_2$  can have both vertical and horizontal components. In other words, by adding the lengths of  $L_1$  and  $L_2$ , one cannot determine the actual height of the distant tip of the arm from the reference plane. For example, in Fig. 1 of the reference, assuming the spherical wrist (25) of the robotic arm represents the distant tip of the arm and symbolizes the vertical region that can be accessed by the arm, the addition of the values  $L_1$  and  $L_2$  is not equivalent to the total distance from the spherical wrist (25) to the Y plane. Thus, the reference does not appear to teach the selection of a vertical region as in the present invention. Applicant requests reconsideration and withdrawal of the rejection of claim 1 under 35 U.S.C. § 102(b).

### **Allowable Subject Matter**

The Office Action admits that claims 2-5 and 8 contain allowable subject matter and would be allowable if the claims are rewritten in independent form and the indefiniteness rejection under 35 U.S.C. § 112, second paragraph, is overcome. Applicant has rewritten claim 8 in independent form. Applicant's remarks have overcome the 35 U.S.C. § 112, second paragraph rejections. Accordingly, claim 8 and claims 3-5 are allowable.

Claim 2 depends from claim 1, which is allowable for at least the reasons discussed above. Therefore, Applicant requests reconsideration and withdrawal of the objection to claim 2.


### **Conclusion**

Applicant's amendments and remarks have overcome the rejections set forth in the Office Action dated October 3, 2003. Specifically, Applicant's remarks and amendments to claims 1-8 overcome the rejection of claims 1-8 under 35 U.S.C. § 112, second paragraph. Applicant's remarks have distinguished claim 1 from Gretz and thus overcome the rejection of this claim under 35 U.S.C. § 102(b). Claims 2-5 and 8 contained allowable subject matter. Accordingly, claims 1-8 are in condition for allowance. Therefore, Applicant respectfully requests consideration and allowance of claims 1-8.

Applicant submits that the application is now in condition for allowance. If the Examiner believes that the application is not in condition for allowance, Applicant respectfully requests that the Examiner contact the undersigned attorney by telephone if it is believed that such contact will expedite the prosecution of the application.

The Commissioner is authorized to charge payment for any additional fees which may be required with respect to this paper to our Deposit Account No. 01-2300, making reference to attorney docket number 101213-00019.

Respectfully submitted,

  
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Rustan J. Hill  
Registration No. 37,351

Customer No. 004372  
ARENT FOX KINTNER PLOTKIN & KAHN, PLLC  
1050 Connecticut Avenue, N.W.  
Suite 400  
Washington, D.C. 20036-5339  
Tel: (202) 857-6000  
Fax: (202) 638-4810  
RJH/RN:ksm:tdd  
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